OUTCOME: DURHAM'S CITIZENS ENJOY A HEALTHY ENVIRONMENT

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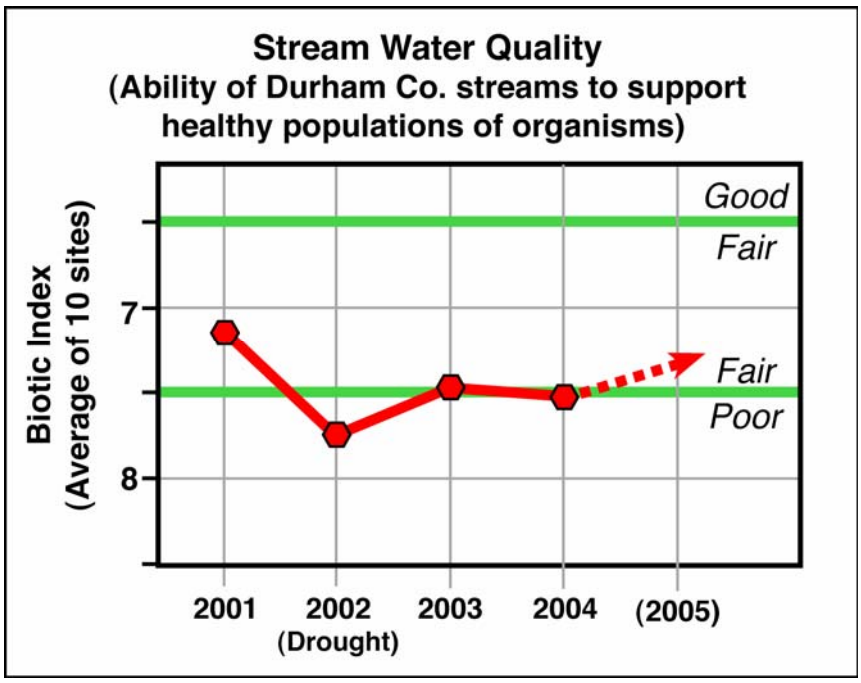
INDICATOR #1: Stream Water Quality

Durham's citizens benefit from clean streams with functioning ecosystems.



The dashed line indicates the desired future trend direction. The expected trend direction, if no action is taken, is expected to show no significant change.

Explanation: *Benthic macroinvertebrates* are invertebrates (animals without bones), mostly insects, that live at least part of their lives on stream bottoms, and which are large enough to be seen without a magnifying glass. These animals are very sensitive to the effects of water pollution, with different species having different levels of tolerance. Therefore, by comparing the different types of benthic macroinvertebrates living in a stream to those living in a healthy stream in the area, we can tell a lot about stream conditions. The animals provide a record of the cumulative or long-term conditions. Benthic macroinvertebrates are also sensitive to non-chemical changes in stream conditions, such as low water due to droughts or large amounts of sediment washed in from eroding land surfaces.

The map of the Water Quality Index (WQI) in 2004 shows how stream water quality varies across Durham. The WQI includes eight measurements: Fecal coliform, copper, zinc, dissolved oxygen, turbidity, total phosphorous, total nitrogen, and biological oxygen demand. Fecal coliform is the main contributor in the Downtown Durham area, while copper is the main contributor in the Stirrup Iron area in southeast Durham County.

Story Behind the Curve

A. All of Durham's monitored streams are listed as "impaired" by the NC Department of Environment and Natural Resources (NCDENR).
B. The main sources of impairment are bacteria, sediment, and changes in stream flow patterns.
   1. Bacteria, particularly *E. coli,* occur at unhealthful levels in many of Durham's streams, most notably those in the downtown area. Based on the spatial distribution of bacteria levels (see map) and laboratory analysis of the bacteria, the probable source of is leaks from aging and deteriorating sewer infrastructure.
   2. Sediment (or dirt) and other heavy contaminants from stormwater are considered by NCDENR to be the most serious pollutant in North Carolina as a whole. In Durham County, half or more of that sediment comes from erosion of stream banks, with the rest coming from erosion of land surfaces. The stream bank erosion is a consequence of changes in flow patterns related to patterns of land use and development.
   3. Impervious surfaces – concrete, asphalt, and compacted ground – shed rainwater quickly into streams rather than allowing the water to soak into the ground, increasing the volume and velocity of the water flowing in streams during and after storms. It is likely that changes in stream flow patterns have a much greater impact on stream function and ecosystems than all of the monitored water quality variables put together. Aquatic organisms get washed away and stream banks erode and collapse when the streams flow unnaturally high and fast following storms, and die off when the streams dry up. Despite these impacts, no government agency has routinely monitored stream flow, and so no data exist on changes in stream flow patterns over time, or in response to specific human activities.

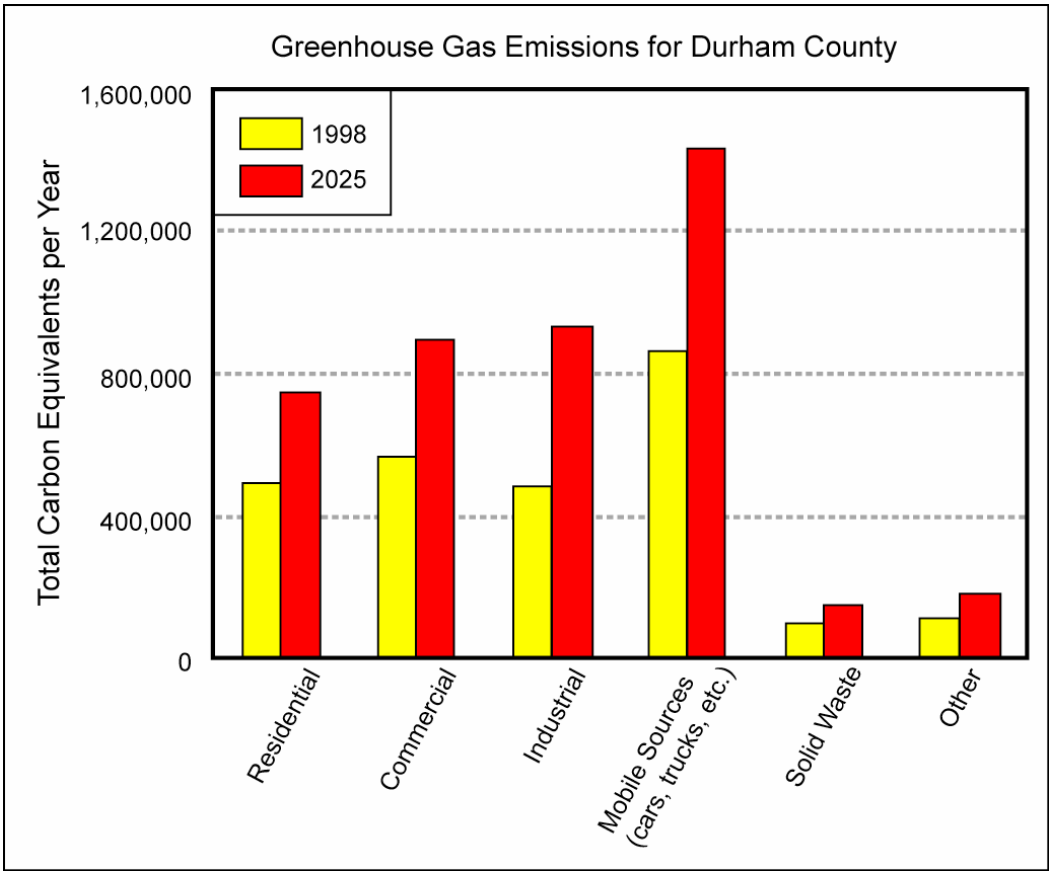
Recommendations

A. Develop and implement a plan to inspect and repair sewer lines in the City of Durham. Use stream water quality monitoring data to identify areas of priority concern.

B. Treat stream water volume and flow rate as water quality issues, and develop integrated management strategies.
C. Encourage the use of natural stormwater management techniques.[1] Begin by implementing them on city and count properties.

INDICATOR 2: Greenhouse Gas Emissions

Durham reduces its impact on the atmosphere and on global climate.



The 2025 projection assumes that the population growth rate and per capita resource use continues at current levels.

Explanation: Each greenhouse gas differs in its ability to absorb heat. The selected indicator, Total Carbon Equivalents per Year, measures the weight of emitted greenhouse gasses in terms of how much carbon, in the form of carbon dioxide, would be needed to achieve the same amount of heat absorption in the atmosphere. This common measure of atmospheric impact is

[1] Information about natural stormwater management techniques is available on the web at: http://www.psat.wa.gov/Publications/LID_studies/LID_approaches.htm, www.epa.gov/owm/mtb/vegswale.pdf, www.appliedeco.com/Projects/EcologicalSystemsAlternativeStormw.pdf, http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/index.asp

obtained by multiplying the weight of the emitted gases by each gas's Global Warming Potential, a measure of the heat absorbing energy of a gas relative to that of carbon dioxide.[2]

Story Behind the Curve

A. Greenhouse gas (GHG) emissions are heat-absorbing gases that trap sunlight near the earth, thereby warming the atmosphere like a greenhouse. The United States emits about one-fifth of total global greenhouse gases. Carbon dioxide from fossil fuel burning (mostly coal and petroleum fuels) accounts for about 85% of these emissions.
B. The main sources of GHG emissions from human activity in Durham are vehicle use (33%) and the use of energy to heat and cool buildings and operate equipment and appliances (59%).
C. The local impacts of global climate change, some of which are already starting to be felt, include: an increase in the frequency of extreme rainfall events and floods; more frequent droughts; an increased number of days per year when ground level ozone is at unhealthy levels; increased incidence of warm-climate diseases such as West Nile Virus; and a shift in the growing season of some plants beyond what interdependent insects and birds can adjust to. Even small changes in these conditions will have large impacts to our economy and to the health of our citizens.
D. The sources of GHG emissions also contribute heavily to local environmental and public health problems, and thus actions taken to reduce GHG emissions will have immediate and local positive impacts. These overlapping problems include:
   1. Ground level ozone, which contributes to rising levels of respiratory ailments such as asthma;
   2. Pollutants, such as heavy metals, which are washed into streams from roads and parking lots;
   3. Obesity, particularly in children, which has been shown to be linked to the absence of "walkable" communities and "sprawl" patterns of development.
D. Reduction of GHG emissions nationwide would increase national security by reducing dependence on foreign oil, and limiting the scale and costs of climate-related disasters such as droughts and floods across the globe.

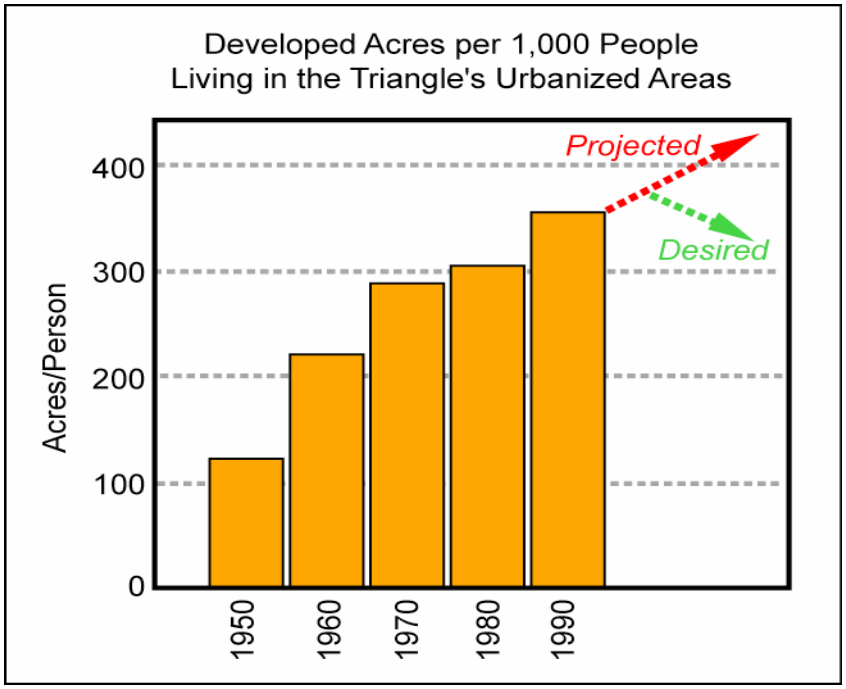
Recommendations:

A. Fully fund the proposed Update to the Greenhouse Gas Inventory and Action Plan.
B. Implement the proposed Action Plan.

[2] For more information about how GHG inventories are done, see http://www.eia.doe.gov/oiaf/1605/gg03rpt/summary/special_topics.html or http://yosemite.epa.gov/OAR/globalwarming.nsf/content/index.html

INDICATOR 3: Land and Biodiversity

Durham's citizens maintain healthy and resilient ecosystems through the protection and restoration of the county's naturally vegetated open spaces.



(Source: Triangle J Council of Governments)

Little Durham-specific information is available; what there is suggests that overall growth rates for Durham have been similar to those of the region as a whole.

Explanation: Although there has been a lot of scientific research on ecosystem health and biodiversity, no one has yet developed a practical metric for tracking these critical but elusive characteristics. Some insight into how Durham's ecosystems are doing could be gotten by tracking how much of our priority lands (as designated in the county's land conservation plans and the Triangle GreenPrint Regional Open Space Assessment) we are preserving (see the following map), and the ratio of conserved open space (for example, forests, meadows, wetlands, and naturally vegetated streambanks) to area of impervious surfaces (hard surfaces such as roads, parking lots, and roofs). Unfortunately, that information is not available at this time.

Story Behind the Curve

A. In total there are approximately 26,800 acres of permanently protected land in Durham County (or 14 percent of all county land). This equates to approximately 0.11 acres of protected open space per county resident.
B. In addition to their beauty and recreational value, healthy ecosystems provide us with essential and irreplaceable services. Forests, meadows and wetlands filter sediment and pollutants out of rainwater before it enters our drinking water reservoirs, reduce flood hazard,

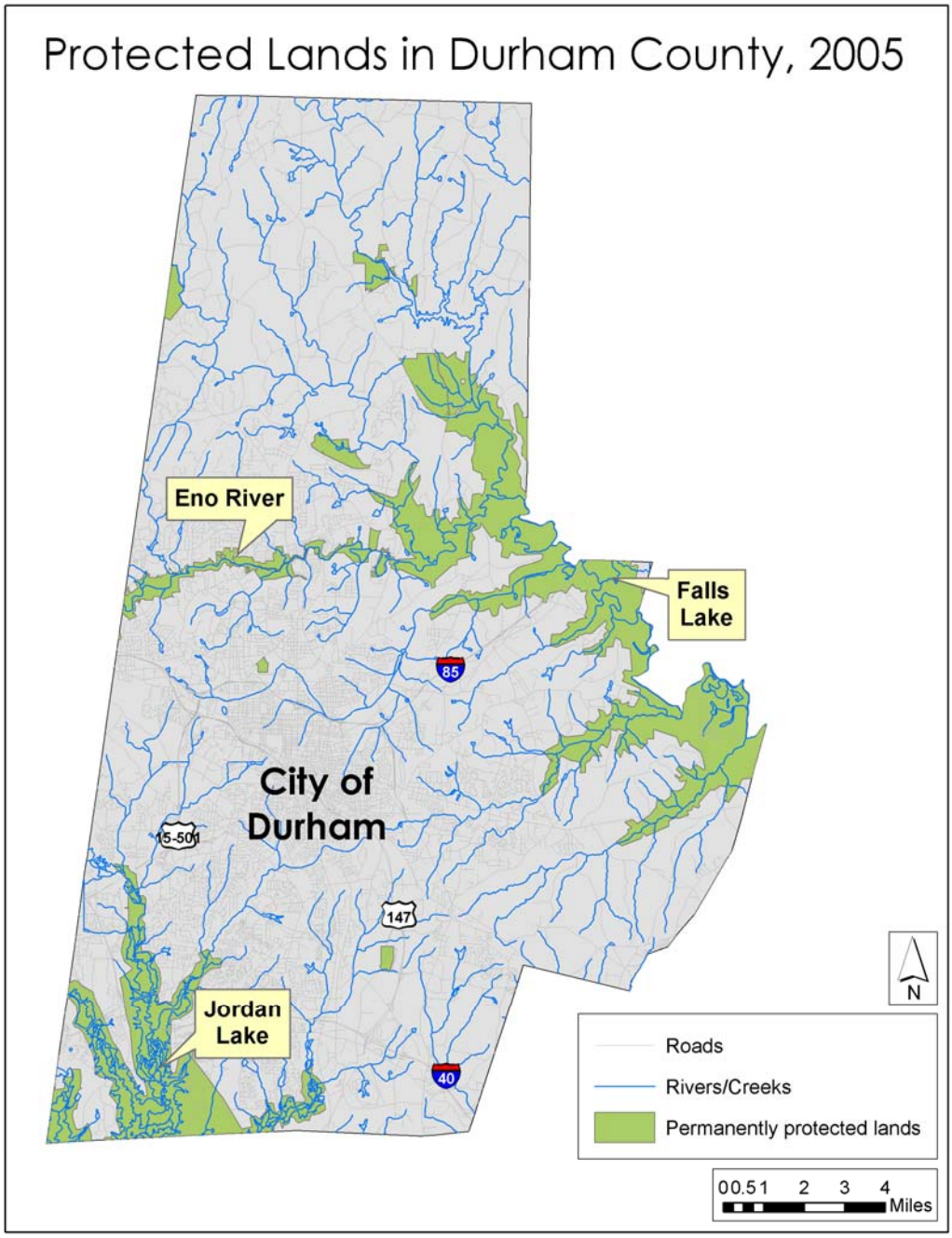
remove carbon dioxide and some pollutants from the air while adding oxygen, cool the air and moderate our weather, and support a balanced population of native plants and animals that keep harmful insect pests in check.

C. In the past 15 years, the population of Durham County has increased over 30% (from 181,000 people in 1990 to approximately 240,000 in 2005). This population growth is nearly twice as much as the nation as a whole, and 3.39% more than the rapid expansion seen across the State of North Carolina. On average, 74 new residents move into the Research Triangle region each day. Our county's population growth has been accompanied by a disproportionately greater expansion of development (shopping centers, housing developments, roads, etc.) into lands previously either forested or devoted to farming. Between 1980 and 1995, the urbanized area of the Triangle increased 104%, while the population increased only 65%.
D. Many of the county's significant natural areas remain completely unprotected. Without increased efforts to permanently preserve open space and significant natural areas, these lands will soon be lost to development.

Recommendations

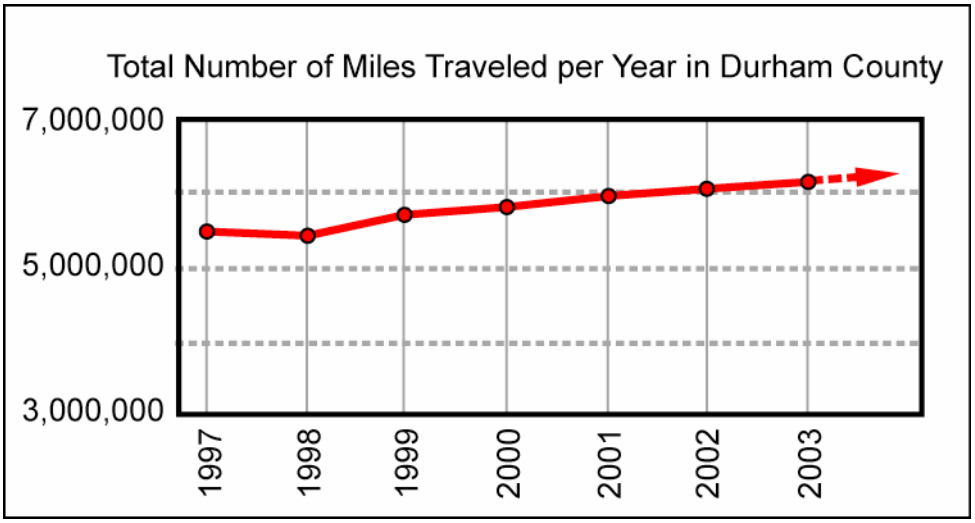
A. Encourage permanent open space protection of publicly and privately owned lands.
   1. Continue to promote the use of conservation easements.
   2. Continue to encourage voluntary permanent protection of present use value lands as open space.
   3. Explore the use of Transfer Development Rights as a tool to preserve priority natural areas.

B. Integrate information regarding a parcel's high priority for protection into the planning and permitting process so that planners and developers are aware early in the decision making process.
C. Expand current efforts to track impervious surface area throughout Durham County. Work with academic researchers and local non-profit organizations to identify and monitor indicators of ecosystem health.
D. Enhance communication and interaction among Durham County's Open Space Program, other interested county and city agencies, and local non-profit organizations such as the Triangle Land Conservancy and the Eno River Association. Partnerships will help to strengthen existing cooperation to protect priority natural areas.


Protected Lands in Durham County, 2005
Eno River
Falls Lake
85
City of Durham
15-501
147
Jordan Lake
40
N
Roads
Rivers/Creeks
Permanently protected lands
00.51 2 3 4
Miles

INDICATOR 4: Vehicle Miles Traveled

Durham's citizens reduce the negative environmental impacts of cars and trucks.



Story Behind the Curve

A. The number of vehicle miles traveled (VMT) indicates the overall level of highway and automobile use. Cars and trucks, and the roads upon which they travel, are major contributors to several environmental problems:

1. *Reduced air quality:* The Environmental Protection Agency has designated the Triangle area, including Durham, as being in "non-attainment" for ozone. Ozone contributes to the increasing incidence of respiratory ailments such as asthma, and is particularly hazardous to the health of children and the elderly. Emissions from cars, trucks, and buses are the major sources of the gases that are responsible for ozone in this region.[3]
2. *Impaired water quality:* As many as half of our vehicles leak hazardous fluids, including crankcase oil, transmission, hydraulic, and brake fluid, and antifreeze. Tiny particles worn off of tires by the road surface add toxic metals and suspended solids to streams and lakes. As discussed above (Water Quality Indicator), roads and parking lots also alter stream and groundwater flow patterns in ways that are destructive to ecosystems and that degrade drinking water quality.
3. *Degradation of wildlife habitat:* When new roads are constructed, large patches of forests and meadows get broken up into smaller patches. This habitat fragmentation contributes to local species extinction and biodiversity loss by separating a species from its feeding or

[3] In an analysis released March 3 2004, the Natural Resources Defense Council and the Surface Transportation Policy Project looked at EPA's most recent emissions data for the 154 counties in 23 states that EPA recommended for designation in December 2003 as nonattainment under the eight-hour ozone standard. The analysis found that "more than half of the areas entering nonattainment status for the first time receive the lion's share of their smog-forming pollutants from the transportation sector." In the 154 cities and counties, cars and trucks contribute about 35 percent of the total smog-forming pollutants, while power plants, factories and other facilities contribute 29 percent. Dry cleaners and other miscellaneous sources are responsible for another 24 percent of emissions, and construction equipment and other non-road sources emit about 12 percent.

breeding grounds, or by dividing a large and genetically diverse population into groups that are too small and isolated to survive. A few species, like deer and raccoons, can adapt to human-shaped environments, but many more cannot. By building more roads to accommodate our cars and our suburban lifestyle, we are essentially cultivating large numbers of a few species while the total number of species drops dramatically.

B. The Daily VMT increased 43% between 1991-2000, while population increased 26% between 1990-2000. Another 26% increase in population is projected by the year 2020.

D. Traffic congestion continues to get worse in the Triangle; local drivers spent 52 percent of their commuting time in congested conditions in 2003 – the first time this measure has exceeded 50 percent. Traffic jams cost the average Raleigh-Durham commuter 18 gallons of wasted fuel and 27 hours of wasted time in 2003.[4] The percentage of peak hour auto travel that occurs under highly congested conditions is projected to increase from 15 percent today to 29 percent by the year 2020 even if all the road capacity expansions presently planned are built.[5]

Recommendations

A. The City and County governments should serve as role models by very publicly taking steps to reduce emissions from government-owned vehicles.

B. The City and County governments should continue to develop infrastructure and incentives to support use of alternative modes of transportation, such as bikes and buses.

C. A plan should be put into place to integrate the environmentally sensitive "Smart Growth" concepts articulated in the recently adopted Comprehensive Plan into the Unified Development Ordinances. Currently, there is no mechanism in place to insure that these sound ideas get put into practice.

[4] Texas Transportation Institute, May 2005, http://mobility.tamu.edu/ums
[5] Triangle Transit Authority